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COLLECTING INSECTS AT NIGHT.

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COLLECTING insects at night is by no means engaged in to the same extent as day collecting, yet night collecting is far from being neglected. Insects in their season abound by night as well as by day, but those which are active at night seldom appear by day, and those that are found in daytime are not generally caught at night, although a lapping of the two tendencies is evidenced by some common forms which appear only at twilight or dawn. Consequently, two popular distinctions among insects are established by reason of their choice of either daytime or night-time for period of activity, and the terms *diurnal* and *nocturnal* are familiarly applied. Aside from the preference for day work rather than night work in any pursuit, and collecting is no exception in this respect, the inducements for collecting at night are, however, considering the abundance, importance and variety of nocturnal forms, about equal to those attending day collecting. Some collectors assert that discoveries of new species are more certain to reward night work than operations by day; hence the thorough collector needs to divide his time somewhat between day and night.

In contemplating the present scope of entomology, the student becomes impressed by the remarkable number of species now described in our bulky literature, and is apt to believe that about every kind of insect which thrives in our country, or wherever exploration has been conducted, is scientifically known and named, and in many cases renamed, in consequence of which little chance remains for finding new material. This notion cannot endure long in the face of investigation of what forms of insects can be found especially at night. The author can state that as far as his own captures are reported, in regard to some hymenopterous parasites,* more than two species were captured to one old species, and most of them were collected at night in Lawrence. Whether this is an exceptional case or not, the study of other groups collected at same time under the same conditions is needed for the purpose of determining what percentage of new species to old species would constitute an average estimate, particularly in regard to *Microdip-*

* See article entitled "Notes and Descriptions of Hymenoptera from the Western United States in the Collection of the University of Kansas," by H. L. Viereck, in Transactions Kansas Academy of Science, volume XIX, pp. 264-326.

tera and Microlepidoptera, the chief associates taken with the parasites. Much depends on the extent to which any group has been studied that leaves a chance more or less open for addition of new species; for instance, the beetles are so thoroughly known that any chance of finding new species is comparatively slight, while the Microlepidoptera, Microdiptera and hymenopterous parasites are in lessening proportion imperfectly known, and new species are quite frequently detected.

The enthusiast, indeed, who expects the accomplishment of great possibilities in entomological research within the next few years may claim, further, that the prospect for rich systematic discovery lies in going over the field the second time, to which we are already becoming accustomed, for the purpose of revision, and, in connection, the search for night forms deserves extended recognition, while at any time it presents a hopeful incentive to collect in territory otherwise considered well worked. Really, in spite of the present advanced state of entomological science, the combined knowledge of the insect fauna of our country in general is, perhaps, still regarded by some workers as having progressed but little beyond the superficial stage. In fact, the names of new species are constantly swelling our already crowded lists, and, what is remarkable, discoveries of new species are often made in old-settled localities long familiar to entomologists. Attention has been given principally to the larger forms of insects, while a host of little things, the greater proportion probably being night denizens, doubtless remain unknown everywhere, and all that is needed to disclose them to science is a larger number of diligent workers, both collectors and students.

Not only the beginner in insect study, but the teacher and experienced collector as well, can find instructive diversion combined with healthful recreation in the cool, refreshing, open air of summer nights by devoting part, if not all, of evenings to collecting specimens. Possibly the student may be regularly employed by day in business or trade, especially since many students are obliged to work in summer-time; but in the evenings, when the time is usually one's own, a grand opportunity for acquaintance with our insect neighbors awaits him ready at hand, whether the interested person is situated in country or city. Employment by day, then, no matter how confining it may be, in business or other calling, should not bar a person from making a collection of insects as long as evenings are free, and in this respect entomology has an advantage over other

branches of science in which material cannot be so readily secured at night.

Changes of weather and influence of the moon have a wonderful effect on the movements of insects at night. Warm, damp, dark nights, without perceptible wind, afford the best conditions towards inducing night insects into activity; then they may be noticed in throngs hovering about every exposed light. At other times, when insects do not appear in ordinary numbers at the lights, the principal reasons may be due to a chilliness of the air or to a strong wind, in which cases only few of the stronger and hardier species seem to venture out of their haunts. Even on other occasions, when there is no shining moon, and all conditions are apparently favorable for impelling insects to fly, the collector will sometimes meet with disappointment, and be unable to account for the scarcity of specimens around artificial lights. At such times, as well as when the moon is shining, the collector should direct his attention to other methods of collecting, such as the sweeping of herbage, which can be resorted to particularly on chilly or windy nights; and, in case of moonlight, he should remember to select the shaded portions in thickets, woods, orchards, or parks. A friend with whom I have used the sugar bait relates that he never noticed any difference in collecting whether the moon shone or not; in fact, he paid no regard whatever to either moonlight or dark nights, but went ahead just the same for one night as another. Doubtless the insects prefer to remain in hiding whenever the moon shines, for they are commonly active before the moon rises, if after dark, or should it set before dawn, they stir about somewhat. The suddenness with which good collecting has failed time and again just at the rising of the moon is remarkable.

The practical collector will soon learn to note the conditions presented each night before he starts operations, and so can guide himself in the selection of the proper course to adopt in obtaining the best results. On rainy nights he might open a window or two of his room opposite to the direction of the wind, thereby being shielded from rain and in the path of insects flying against the storm, and there catch whatever comes in to the light; for, in warm weather, such conditions are often extremely favorable towards bringing out the insects. Really there is no time throughout the growing season, whatever the conditions may ordinarily be, but what can be used in one way or another to good advantage in collecting. The difficulty will be to keep up the mounting of the specimens as fast as the collecting is done. Only the novice will re-

quire instruction in regard to the mounting and preservation of specimens; otherwise the subject need not be mentioned here. Directions for mounting, also for preparing a collecting outfit, are usually contained in elementary guides to the study of insects, and a book of this kind should be in the hands of every person interested in insect life.

Several methods, as already referred to, are employed in the collecting of insects at night, one of which is the simple and ever reliable practice of sweeping by means of the net, so commonly followed by day. This method has previously been recommended, particularly for action on moonlight, chilly or windy nights, though the captures will mainly be the smaller kinds of insects, such as minute flies of the order Diptera, parasites of the order Hymenoptera, and tiny moths of the order Lepidoptera, all of which, nevertheless, deserve attention and careful mounting. Among these little creatures new species are probable. The curious fact has often been observed that after sunset myriads of these little insects can be swept from grass or weeds which in the hot sunshine of the day seemed almost destitute of insect life. A few minutes of sweeping is generally sufficient for gathering enough material to keep the collector busy for hours with the mounting. Usually at twilight or later the grass becomes wet with dew; consequently net and specimens get sticky with moisture; but if the poison bottle is lined inside with blotting-paper, a plan which it is advisable to follow at any time, and not too many specimens put in together, there is little danger of injury to them. As a further precaution, strips of soft paper, such as newspaper, can also be placed loosely in the bottle, to absorb moisture and prevent specimens from shifting and rubbing each other or adhering into masses too large for safety while the bottle is carried.

One blessing, perhaps, for which we ought to be thankful, is that only certain small groups of night insects are musical; if all kinds of insects were as noisy as some examples of the Orthoptera, there is no telling whether a person, unless he was deaf, would be able to sleep in the summer-time. A year ago last summer the following appeared in a local paper:

“KATYDID SANG ALL NIGHT.

“The neighbors in the 700 block on Tennessee street have been greatly annoyed for the past week by a katydid. It would sing all night long, and sang so loud that some thought it must be a tree-toad. All attempts to shake it from the tree proved useless. It was caught last night, and could be termed a giant katydid. It

measured about an inch and a quarter long and had a very large body; its wings were immense. It will be a good specimen for one who is collecting insects." (From *Lawrence Journal*, August 4, 1904.)

On inquiring if the specimen could be obtained, it was learned that chickens had eaten it. However, my disappointment was banished a few nights later when a strong rasping noise was heard issuing from a tree which stood near my home, and as the shrill sounds continued all night it was evident that an accommodating specimen of what was wanted had located there for my benefit. A night or two after, when another songster in another tree began calling also, the conclusion was reached that it was time to make an attempt, at least, to capture one or both of the supposed insects. Provided with lighted lantern and poison bottle, one night, the author climbed the tree, a moderate-sized elm, in which the first fiddler was harbored, and located the fellow by his racket. He was a little cautious as my light approached him and stopped his fiddling, but remained within reach, although attempting to conceal himself among leaves on the under side of a branch. With one well-aimed grab he was secured in my hand and soon reposed safely in my poison bottle. However, his comrade in the other tree, a smaller elm, repeatedly evaded me by climbing out on the tips of branches beyond reach and out of sight. The captured specimen was identified as *Cyrtophyllus perspicillatus* Linnæus, and is now the only example of its species in the collection of the University of Kansas.

Some years ago, while living in Colorado Springs, the business of insect collecting was one night unexpectedly forced upon me. A migration of locusts, the Long-winged grasshopper, known as *Dissosteira longipennis* Thomas, was evidently detracted from flight over or near the city by the electric lights, directly after dark one evening, and the streets soon became covered with the living insects. In seeking every source of light, they invaded open places of business faster than they could be cleared away. They were caught in handfuls and flung into pails of scalding water to end their struggles. The sidewalks and street-crossings of several business blocks were covered so thickly that people walking there would crush a mass of bodies underfoot at every step. Next morning the street cleaners carted off dead grasshoppers by the wagon-load, and for fear another invasion might come, the streets were not lighted for several nights afterward. This phenomenon occurred on Thursday evening, July 21, 1898; and the ridiculous part of the affair was

the claim made in the daily papers that the insects came from Kansas, when, as a matter of fact, the species is more native to the Colorado plains.

Regular methods of night collecting, besides sweeping, depend on two agencies as means of attraction or lure. The principal one is artificial light, as already mentioned; the other some savory bait. Any kind of artificial light, if exposed, attracts insects, but not all insects are attracted by light. A bait, therefore, which allures by scent, and gratifies the insect taste, must be used for those that do not come to light nor can be found by sweeping. The readiness and persistence with which insects generally seek a source of light carry myriads of them to destruction, either by fitful dartings into flames of candles, lamps, and jets, or by onslaught of multitudes in the electric arc lamps. The screening of windows and doors of houses is not only serviceable against day insects, but prevents great annoyance at night from insects which would otherwise freely enter should windows or doors be opened; indeed, many insects are small enough to pass through fine screening. Every person is familiar with the movements of insects in fluttering around a light in a room; at least such as enter in spite of barriers, and cause provocation. In view of such tendencies as these, the collector does not always have to go after his game, for, instead, it comes to him readily; he need not leave his room at times, and nothing more than poison bottles are required in which to catch the specimens. Even some invalids can have the privilege of collecting in this manner.

Wonderful results can be accomplished merely with the aid of a flickering candle-light. My favorite method was accomplished with the use of a lantern supplied only with a candle. With this modest provision, not only was much pleasure derived for myself, but also for my little daughter, who ably assisted me. We would sit out of doors during the summer evenings, either on the porch of the house or in the yard, and together we watched for and captured the insects that were attracted to the light of this simple lantern, which was placed in the center of an open newspaper spread on the floor or ground. The sheet of paper exposed the insects which alighted on it to easy capture. Beetles generally fell on the paper and were picked up in the fingers and dropped into a poison bottle by themselves; they have hard bodies, and make frantic struggles in the bottle before they are subdued by the fumes, and, in consequence, would ruin moths or weaker insects if placed in the bottle together. Tiny moths, parasites and bugs usually alighted on

the glass globe of the lantern, over the surface of which they ran actively, but were captured, one at a time. The open mouth of a poison bottle was dexterously placed over a specimen, confining it against the globe of the lantern until it entered the bottle, which was then quickly closed with the cork held ready in the other hand. Two bottles at least are needed by each person engaging in this process; after a specimen is captured, the bottle should be set aside to allow time for the captive to succumb to the deadly fumes and cease struggling; else, if the bottle is opened too soon, the specimen will escape; meanwhile the other bottle is used for catching a specimen, after which it, too, is set aside, and then the first bottle is used again. Such operations often become quite exciting in efforts to catch exceptional specimens or others that were more or less prized. My little daughter was exceedingly entertained, and many times awaited impatiently for the evening to grow dark enough to begin collecting. Although but nine years old, she has developed quite a knowledge of entomology, and can rattle off big technical names that would perplex the average grown person. Moreover, she has no fear in handling live insects, such as the harmless ones, which are often attentively observed, and besides she has learned to pin up specimens after they are dead as neatly and properly as a professional collector can do. Other children, following the examples of their parents, detest the "crawling things," as they are called, usually with fearful, though needless, abhorrence. Thus, what should provide entertainment and instruction even for children is too generally condemned, and much that could be learned from nature in a simple way is lost. On the other hand, influence once started in the right direction often spreads rapidly. Before very long the neighbors' children had acquired outfits similar to what was provided for my little girl, and their combined excursions in daytime made the vicinity a fateful one for unwary insects, especially butterflies.

The stronger the light the more attractive it becomes to insects; consequently, the electric arc lights on the streets of town or city probably draw insects from long distances. However, collecting at night on the streets or at public places brings a person thus engaged more to notice than in day collecting, when the collector can seek the country. But electric lights cannot be forsaken without a lack of valuable specimens, particularly moths. Therefore, the collector is obliged to take a position directly under the glare of a light, where his movements draw the attention of people passing along the sidewalks. Ofttimes an inquisitive spectator will call

out, "What are catching?" "Insects! What do you catch them for?" "What do you do with the bugs?" and similar questions; while another observer, perhaps, interposes a rude joke. Or a number of boys will suddenly offer their services and pick up every insect that can be found, since many fall on the ground—moths which flutter until their wings are battered or torn beyond recognition, and the commonest kinds of beetles—all of which are promptly presented to the collector with a shout, "Here, mister! here's a bug!" until he is either distracted with importunities and worthless specimens or forced to move to another location and avoid such associates. Two or more persons collecting together with the same interest afford companionship which gives a mutual feeling of relief from arousing undesirable notice which one person would bear alone, but such company is not always possible.

Only net and bottles are needed in visiting lights on the streets. Electric lights are usually hung quite high, though not as high above side streets as on business streets. Rather than carry a long, unwieldly pole as a handle to my net for reaching lights, it is my custom to let the light down as low as desired by releasing the tackle, after the manner of a trimmer; hence, am enabled to reach the hovering insects with my net on an ordinary length of handle. When done with the light, it is raised to usual position. Care should be exercised to keep one or more bottles exclusively for killing moths, which when dead should be turned into a separate bottle for storage; then the collecting bottles can be used for fresh captures, and as the live moths are not allowed to flutter in with the dead specimens, one danger of injury by denuding of wings is avoided.

Sometimes fine specimens may be found on the ground where they alight or fall. The season for favorable collecting at electric lights begins in Lawrence in the first week of May and it may be said to last for fully six months. Whenever a brisk breeze is blowing, insects fly towards the lights on the side facing the wind; as, for instance, if the wind is south, the insects hover in a trail on the north side. The best place for finding insects in greatest numbers at electric lights in Lawrence was found on the river bridge (over the Kansas river), particularly at the south approach, which is somewhat higher than the north end, but whether this slight difference should account for the greater amount of insects appearing at the south end cannot be stated. Here the aquatic neuropteroid forms, such as May-flies and caddice-flies, became most numerous in July and August. The former are very frail insects and cannot

fly far from the water from which they emerge. It is noticed that they always face the wind, whether at rest or in flight, even should they be carried backwards on the wing. Interesting records could be written from observations regarding night insects. Some of these from my notes are as follows:

“July 27.—Slight rain before dark and May-flies were exceptionally thick around the lights. The floor of the bridge was so thickly covered with these insects that their wings gave the effect of snow, while the woodwork along the sides was coated with white molted skins. One kind of May-fly (*Polymitarchys albus* Say), after falling to the floor, seems unable to rise again, and there batters its wings into shreds in the futile endeavor to fly, until too feeble to flutter longer, when it dies from exhaustion. On close examination their legs are found to be rudimentary or aborted, and therefore too weak to enable the insect even to crawl. This kind has been noticed during the entire week.”

“July 30.—The very smallest kind of May-flies (*Caenis diminuta* Walker) are the first to appear at dusk, when they come in great numbers. The larger kinds appear shortly afterwards, and in such multitudes that the electric-light globe soon becomes choked with their bodies, in a mass so densely packed that the light is obscured. At ten o’clock, or soon after, the insects have mostly dispersed.”

Remarks to above.—As a rule, good collecting at lights ends about an hour after dark. As soon as darkness settles, the larger insects generally come with a rush to the lights, but they seldom linger in force very late.

“August 1.—On river bridge just after dark. Myriads of small May-flies flying against the wind to the electric light suggested the appearance of a tail to a comet when viewed from a short distance. Very few caddice-flies out.”

“August 3.—Insects very thick. The frail White May-fly (*Polymitarchys albus* Say) was more abundant than usual, and multitudes literally lay in a compact bed on the floor of the bridge, vainly flopping their wings to pieces in trying to rise. Their egg-clusters were scattered about thickly among their bodies.”

“August 5.—The common kinds of May-flies were nowise as thick as usual. Found more of the Black caddice-flies than ever before in one evening.”

“August 10.—Mostly large moths out. The dead bodies of a considerable number of May-flies were seen sticking by the wings in all sorts of positions to the framework of the bridge, where the

live insects had probably been dashed during a rain-storm of the night before and there left to perish helplessly."

"August 11.—May-flies and caddice-flies somewhat scarce."

"September 21.—On the bill-board near the bridge, the caddice-flies were congregated in numbers, and the noise produced by contact of their bodies as they alighted on the paper was like a continual tapping sound, which first drew my attention."

"October 5 and 6.—On bridge each night between eight and nine o'clock. Nights cool, with full moon shining. Insects were more numerous on these moonlight nights than on dark night preceding. Watching carefully for new species of caddice-fly."

(*Remarks to above.*—This new species was first recognized in my material by Prof. V. L. Kellogg, but it was named by Nathan Banks, from specimens sent to him, as *Hydropsyche kansensis*.)

A favorite location for beetles and moths was found at the light in South park. Here the light was frequently lowered. Wherever game is to be found, there the hunter seeks it. We cannot blame some people who, not knowing about an entomologist's business, may express wonder at his strange actions, particularly if on a street corner at night. But when they begin to question your mental condition, you will probably guard your conduct. A certain party asked a friend: "What is the matter with Mr. T.; is he crazy?" The friend, rather astonished at the question, which seemed to be asked in earnest, replied that Mr. T. had always acted all right; at least he had never done anything strange as far as known; therefore, could not account for such an impression. "Well," the party explained, "he acted very queer the other night. He stood near the lamp-post on the opposite corner of the street and waved and jerked his arms in the air, jumped about on the sidewalk, and ran around the lamp-post several times."

The use of traps in which to catch insects at night, by the allurement of light, is an important method receiving but partial attention. The advantage of a trap is such that, after once rigged up for the night, it "works while you sleep." But next day the work will fall on the collector, who has the catch to pin up. Some traps are so constructed that insects may be allured directly into one, in attempts to reach the light placed inside; another form is arranged to catch insects which fall into it after reaching the light that is openly exposed above it. In any case, however, the insects meet death in a poison jar fixed to receive them, and which is usually charged with cyanide of potassium, although other agents for suffocation, as chloroform, for instance, can be applied.

An outfit of the latter kind was taken and used on a collecting trip for the University of Kansas, under direction of Dr. F. H. Snow, in Hamilton and Morton counties, western Kansas, June, 1902. A large street lantern was furnished to supply the light, and the collecting device consisted of a gigantic funnel, made of heavy tin, painted outside, but left bright and smooth inside, and it converged into a receiver, about the size of a large fruit-can, which could be opened by withdrawal of the bottom in order to allow a cyanide jar to be inserted at time of beginning operation for the night, and to be removed and emptied in the following morning. A tripod of rough poles was erected as a support for the funnel, with the lantern hanging directly over its mouth. Our experience in using this outfit has been related in the account of the expedition, published by the author in the *Kansas Farmer* of December 4, 1902, from which the following is quoted:

"Also, every night the large lantern was lighted and the big funnel hung underneath to trap the insects which fell into it. The light from the lantern served to illuminate the camp finely, though only on one night did it pay as an attraction for insects, but at this time its returns were immense, probably due to a lull and change of wind, which afforded the right condition for insects to fly. Moths and beetles appeared in continuous swarms and fluttered in the circle of light, numbers of them falling into the funnel or onto the ground, and the doctor hastily called out all hands to capture them. Care must be exercised always to prevent injury in catching the delicate creatures; but here the great number of beauties which fluttered in sight nearly drove the doctor to distraction for fear their perfect condition would be marred by beating their wings against the sides of the funnel or on the ground as they endeavored to regain their flight. He groaned aloud, as if the sight of so many prizes gave him a pain, being unable to catch every one that he wanted. Really, the party presented a comic, as well as an animated, scene; the effect of the members in prancing around the lights, whirling nets frantically in the air, or in searching the ground for choicest specimens of the fallen hosts, amid a din of excited exclamations, mingled with the doctor's groans, would have afforded an entertainment for an audience. All efforts were fully repaid at last, for the poison bottles became crammed to the limits with the catches, and the whole party was thoroughly tired before the supply showed signs of failing."

I might mention, however, that the camp was located at the

edge of a thicket along the bank of the Arkansas river, a few miles east of the town of Coolidge.

The danger of specimens injuring themselves is quite well prevented in the box-trap, designed on the plan as mentioned for direct entrance to enclosed light. The width of opening into the trap depends on the space allowed between the edges of two inclined panes of glass which guard the front of the trap. They can be set as desired. For Microlepidoptera, the aperture was narrowed so that anything large enough to do damage could not enter with these tiny and extremely delicate moths. The box was made of heavy tin, painted outside to prevent rusting, but left bright within. An oil lamp was placed at the back end, which is partitioned by a pane of glass from the inner chamber, where the insects are allured by the light shining through to the front. In the bottom of the interior an opening is cut to permit the insects to drop into the poison jar, a Mason pint, which is held in place by a screw ring, made by the center being cut out of a cap, thus providing easy attachment or removal of the jar from beneath. The jar should be strongly charged with poison, since it must remain open when in use, and, for this reason, insects do not die as quickly in it as they would in a closed bottle; hence, if fumes become weak, the captures are liable to flutter too long before they die and mar their wings, as well as of others which they beat. In daytime, after being removed and emptied, the jar will regain strength if closed with a tight cap, or it can be used for storage purposes, or, in a pinch, to kill extra large insects. The price of this trap was five dollars complete.

During the past summer, this trap was used on two trips taken for the University of Kansas, under direction of Dr. F. H. Snow—one to Brownsville, Tex., and the other to Douglas, Ariz. Fully 8000 moths and butterflies were collected at the two places, comprising more specimens of the order Lepidoptera than had ever been caught in any season preceding, and the majority of these were Microlepidoptera, which have required months of work for the spreading of their wings. The use of the trap contributed in a great measure towards this successful collecting.

Besides, hand collecting was engaged in to a large extent in camp. At night, a lighted lamp was set on the camp-table placed in front of the tent where the light shone on the canvas drawn behind it, thus presenting an illuminated screen on which the insects settled in numbers, and from which position, they were easily captured directly into poison bottles. The tiniest moths could be

obtained in this manner in the most perfect condition by careful mode of capture—one specimen being caught at a time, when the bottle was set aside until the insect became stupefied; then the specimen was transferred into a stock bottle. Provided with several bottles, a person could work rapidly for hours into the night, and remain comfortably seated at a table, with equipment and specimens before him.

Only one other method for night work remains to be treated of here, and that is the common practice known as "sugaring." It depends on the use of a bait alluring by scent and tempting to the taste. As mentioned, not all night insects come to light. The wood moths, belonging to the genus *Catocala*, for instance, are only rarely caught in any other way than by sugaring. They are found in secluded thickets or thick woods, which are rather lonesome places for night work. Besides for the sake of company, two persons can work together to better advantage than one alone. The bait is commonly made by mixing beer and molasses, or instead of beer vinegar can be used; and the most effective results are obtained when either or both the beer and molasses are stale and strong-smelling. The mixture is smeared by means of a dauber on trunks of trees and stumps, on logs, or even fence-posts, beginning directly after dark, when the course of operations can be selected with the light of an open lantern. But for inspection purposes, after intervals of about fifteen minutes, a dark lantern, or light otherwise shielded from the person carrying it, is required. Moths, beetles and other kinds of insects are found feeding greedily on the mixture by the collector, who approaches cautiously, with his light thrown on the smeared spots before him. Slowly an open poison bottle is pushed towards a specimen, in case it is a moth, until quite close, when it is quickly clapped over the insect, thus confining it within. Keep the bottle pressed against the tree until, at a favorable moment, the free hand can be thrust over the mouth, and then the cork may be carefully inserted as the fingers slide out of the way. Beetles are generally picked up in the fingers by a quick movement and dropped into poison bottles. In all these matters, practice counts for more than instruction.